Pseudo-aneurysm Associated with Endovascular Re-canalization for Internal Carotid Artery Occlusion

Cho-Kai Wu,1 Jing-Ling Luo,1 Mao-Shin Lin2 and Hsien-Li Kao1

Internal carotid artery occlusion (ICAO) is a relative uncommon but important cause of transient ischemic attack (TIA) and cerebral infarction. The feasibility of endovascular re-canalization has been reported in a recent article. In the present report, we describe a 77-year-old man who received endovascular re-canalization of right ICAO. His clinical symptoms recurred 4 months after the procedure, and follow-up perfusion computed tomography (CT) revealed right hemisphere ischemia. Repeat carotid angiogram showed a large pseudo-aneurysm with narrowed true lumen in the distal cervical carotid artery, most likely resulted from previous re-canalization procedure. A coronary stent was deployed to re-establish patency of the vessel, covering and jailing the orifice of the pseudo-aneurysm. Late pseudo-aneurysm formation should be considered as a potential complication after endovascular re-canalization of ICAO.

Key Words: Internal carotid artery occlusion • Re-canalization • Pseudoaneurysm

INTRODUCTION

Cervical internal carotid artery occlusion (ICAO) is associated with impaired cerebral perfusion, which may lead to ischemic cerebral symptoms and hemodynamic infarcts. Actually, cervical ICAO was associated with an annual risk of 6% to 20% of ipsilateral recurrent stroke despite intensive medical management.1,2 Compromised cerebral blood flow plays an important role in causing ipsilateral ischemic events in patients with ICAO.3 It is documented that endovascular re-canalization for cervical ICAO is feasible, with acceptable clinical results.4 We report herein a case of carotid pseudo-aneurysm developed after successful re-canalization for cervical ICAO.

CASE REPORT

A 77-year-old man suffered from syncope attack 6 months prior to admission, with dizziness for 1 year. Carotid duplex revealed critical narrowing of the right ICA with reversed ophthalmic artery (OA) flow direction, suggestive of occlusion. The left ICA was also narrowed, with > 50% diameter stenosis. Selective cerebral angiography documented right ICAO (Figures 1a and 1b) and left ICA 50-60% stenosis. Distal intracranial right ICA received collaterals from the right external carotid artery, via the ophthalmic artery. Re-canalization of the right ICAO was attempted, using an 8 Fr JR4 guiding catheter positioned in the right common carotid artery (CCA). The occlusion was crossed with a guide wire designed for coronary angioplasty of total occlusion (Conquest, Asahi Intecc, Aichi, Japan), through a microcatheter (Excelsior, Boston Scientific, Galway, Ireland).
The occluded segment was first dilated with a 1.5-mm coronary balloon (Sprinter, Medtronic, Minneapolis), followed by deployment of an embolic protection device (FilterWire EZ, Boston Scientific). A 4-mm balloon (Maverick, Boston Scientific) was then inflated, with subsequent placement of a self-expanding stent (10 × 24-mm Carotid Wallstent, Boston Scientific) across the occlusion. Post-dilation was done using a 5.5-mm diameter balloon (Gazelle, Boston Scientific) within the stent. The final angiogram showed re-established anterograde perfusion (Figures 2a and 2b). The patient was discharged without neurological deficit 2 days later, with daily clopidogrel 75 mg and aspirin 100 mg.

His dizziness improved dramatically after the procedure, with OA flow direction returned to normal by ultrasound. However, dizziness recurred 4 months after the procedure, and OA flow direction was reversed again. Recurrence was suspected and the patient was admitted for repeat cerebral angiography. To our surprise, the angiogram showed no restenosis, but a large pseudo-aneurysm with significant true lumen compression distal to the stent (Figures 3a and 3b). An 8 Fr JR4 guiding catheter was then placed in the right CCA, and a coronary angioplasty guide wire (Runthrough NS, Terumo, Tokyo, Japan) was advanced to the right ICA true lumen. A 2.5-mm Sprinter balloon was inflated at low pressure, followed by deployment of 4 × 30-mm Driver stent (Medtronic) over the stenosis, jailing the entrance of the pseudo-aneurysm. The final angiogram showed no residual luminal stenosis, and the volume of and flow into the pseudo-aneurysm sac decreased significantly (Figures 4a and 4b).

**DISCUSSION**

ICA occlusion (ICAo) is a relative uncommon but
important cause of transient ischemic stroke (TIA) and cerebral infarction, with annual ipsilateral stroke rate of 6-20% despite medication. Carotid endarterectomy (CEA) is proven in patients with ICA stenosis, but not in ICAO. Surgical bypass also failed to show any benefit in ICAO. The feasibility of endovascular ICA re-canalization has been reported recently. Potential complications of endovascular treatment for ICAO may include embolic stroke, vascular access complications, carotid artery injury with dissection or perforation, and hyperperfusion syndrome. In the present patient, pseudo-aneurysm formation with significant true lumen compression occurred 4 months after the procedure. To the best of our knowledge, this complication has never been reported in the literature, but is clinically relevant and should be closely monitored after ICAO re-canalization.

The etiology of pseudo-aneurysm formation in the present case is elusive, but it is most likely due to the injury induced by the guide wire. Conquest wire is very stiff and sharp, easily causing arterial trauma or even perforation. A non-penetrating injury distal to the occluded segment may thus become a weakened nidus, and expands as the pressure is restored by re-canalization and stenting. The other alternative is trauma caused by distal protection device. It is known that PercuSurge GuardWire balloon may cause distal vessel injury, but FilterWire is used in this case. The rim of FilterWire basket may cause vessel injury, but the pseudo-aneurysm in this case is much proximal to where the FilterWire was placed. In the present case, the true arterial lumen was

Figure 3. Angiogram demonstrating pseudo-aneurysm (white arrow) distal to the previous stent (dark arrow), with significant compression of the internal carotid artery.

Figure 4. After deployment of coronary stent (Driver stent 4.0 x 30 mm) across the orifice of the pseudo-aneurysm. The size and flow in the aneurismal sac decreased, and the lumen of the distal internal carotid artery restored.
compressed by the enlarged pseudo-aneurysm, leading to recurrence of occlusive symptoms. The other possible consequence of the expanding pseudo-aneurysm is rupture of the sac and disastrous bleeding. Both scenarios are clinically significant, therefore close follow-up is necessary following endovascular ICAO re-canalization.

Endovascular repair has been reported in traumatic or post-operative carotid pseudo-aneurysms with various techniques, including placement of self-expanding stents with coil-assisted thrombosis of the aneurysm sac, or placement of covered stents. The stent-coil approach is more technically demanding, with potential risks of aneurysm rupture during coil insertion or coil embolization into the distal ICA. The use of a covered stent is not without drawbacks either, as the chances of late stent thrombosis, thrombo-embolism, and restenosis may be higher. Our approach was to implant a large balloon-expandable coronary stent to cover the orifice of the pseudo-aneurysm, restoring optimal flow in the true lumen. With vessel diameter of 4-mm, the restenosis rate should be low. And as the volume of blood flow into the aneurysm sac diminished immediately after stent deployment, we believed that thrombosis of the pseudo-aneurysm would ensue shortly after the procedure. Regular ultrasonography and CT angiogram will be scheduled for adequate follow-up of this patient to ensure complete thrombosis and obliteration of the aneurysm sac.

Surgical open repair is another possible approach for the management of pseudo-aneurysm. However, the pseudo-aneurysm in the present case was located well above the mandibular angle, and open repair would have been technically demanding. The implanted stent may also be damaged during the surgical exploration or clamping of the arteries. Endovascular approach also carries less invasiveness in patients with high surgical or anesthesiological risks. As endovascular treatment for ICAO has been studied recently, the optimal management of its potential complications should also be explored. In conclusion, we have presented a case with late pseudo-aneurysm formation after endovascular re-canalization of ICAO. A coronary stent was implanted to cover the orifice of the pseudo-aneurysm and restore lumen patency of the compressed ICA. Surgical repair with high technical difficulty was thus avoided, and the restenosis rate should compare favorably with that of covered stent.

REFERENCES

內頸動脈閉塞是相對罕見，但重要之導致暫時性腦缺氧及中風的因素。外科的繞道手術雖是理論上的解決方法，但大規模的研究卻發現預後並沒有顯著的改善。最近臨床研究顯示可以用經皮血管腔內技術開通完全閉塞的內頸動脈。在這份病例報告中，描述一個 77 歲的男性，接受經皮血管腔內技術開通完全閉塞的右內頸動脈並置放支架四個月後，臨床症狀再度出現。斷層掃瞄顯示右大腦缺氧的情形仍然存在，而血管攝影發現在之前支架的遠端出現了偽動脈瘤，壓迫內頸動脈造成管腔狹窄。這是從前的臨床報告從來沒有發現過的。我們在內頸動脈內置放支架，跨過偽動脈瘤的開口，流入偽動脈瘤動脈之血流明顯減少，且內頸動脈之管腔及血流亦恢復正常。這份病例報告描述了之前從未報導過的併發症，及其治療處置方式。今後在開通完全閉塞的內頸動脈時，也要考慮遠期偽動脈瘤出現的可能性。

關鍵詞：內頸動脈閉塞、再開通、偽動脈瘤。